STATUS OF GYPSY MOTH POPULATIONS AT INDIAN HEAD NAVAL ORDNANCE STATION

Prepared by

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INTRODUCTION

On September 8, 1993, USDA Forest Service personnel conducted a gypsy moth egg mass survey at Indian Head Naval Ordnance Station. The purpose of this survey was to determine gypsy moth population densities and to assess the potential for defoliation and the need for treatment in 1994.

METHODS

Gypsy moth survey plots were randomly selected based upon available host trees (oaks), size of sample area, uniformity between egg mass counts, and available time. At each sample point, a 1/40th acre fixed-radius plot was established.

The fixed-radius plots (radius 18.6 feet) consisted of a tally of all the new (1993) egg masses observed on the overstory trees, understory vegetation, ground litter and duff. The total number of egg masses observed for each plot was then multiplied by 40 to determine egg masses per acre using the following equation:

$$Y = 40X$$

where,

Y = egg masses per acre

X = number of egg masses observed in the plot

RESULTS

The results of the survey are presented in Table 1. The survey plot locations are shown in Figure 1. In brief, site-wide egg mass densities ranged from 0-10,280 and averaged 495 egg masses per acre. The majority of the egg masses are located in a 175 acre area in the Stump Neck section of this facility (Figure 2). Egg mass densities in this 175 acre block ranged from 40-10,280 and averaged 2,656 egg masses per acre. The egg masses were large (quarter size and larger) and appeared healthy. Oaks, the preferred food of the gypsy moth, are abundant in this area and make up at least 50 percent of the overstory.

DISCUSSION

The basic guidelines used to predict the degree of defoliation include evaluation of the past defoliation history of the area in question, number of egg masses/acre, size and condition of the egg masses, available preferred food, terrain and risk of larval blow-in following egg hatch. Potential defoliation is categorized as follows: light (1-30 percent); moderate (31-60 percent); and heavy/severe (61-100 percent).

Gypsy moth populations are sufficient to cause heavy defoliation (61-100 percent) in the 175 acre area of the Stump Neck section of Indian Head Naval Ordnance Station highlighted in Figure 2. No noticeable defoliation is likely to occur elsewhere at the Station in 1994.

The infested area at Indian Head Naval Ordnance Station exceeds the treatment threshold of 1000 egg masses per acre commonly used by timber managers to prevent tree mortality. The results of this survey should be used in conjunction with any other resource management objectives to assess the potential impact that both heavy defoliation and possible tree mortality would have in meeting your management goals. Predicting the extent of tree mortality that would occur after one year's defoliation is difficult. Generally speaking however, a stand of trees that is not stressed by other agents during or immediately following a single heavy defoliation will likely pull through with only minor branch dieback and minimal mortality. Trees

that have been subjected to two or more years' defoliation, or trees that are stressed by other agents, will have the greatest risk of mortality.

Trees that are defoliated in excess of 60 percent normally refoliate the same growing season. Such events cause the trees to expend valuable energy reserves to refoliate, and consequently cause the trees' health to deteriorate. Depending on the condition of the trees at the time of defoliation, reduced growth, branch dieback or in some cases tree mortality, are likely to occur following a single year of heavy defoliation. Should subsequent defoliation occur the following year, the impact is compounded. Trees that receive light-moderate defoliation (<60 percent) generally will not refoliate and there is probably no significant impact other than some reduction in growth.

Trees at greater risk for branch dieback or mortality are those that are presently stressed from other factors, such as: 1) soil compaction from roads, sidewalks, parking lots, machinery and/or heavy foot travel; 2) over maturity; 3) drought; 4) shock due to recent timber cutting activities; 5) previous year(s) defoliation; and 6) other insect and disease related problems.

An example of the potential impact, in terms of dollar value, is provided by a damage appraisal conducted by the Pennsylvania Bureau of Forestry on 255,290 acres following a gypsy moth outbreak. The loss assessment showed that tree mortality that occurred between 1984-87 averaged $174.49 per acre (using 1987 stumpage values). On the Allegheny National Forest, in untreated stands consisting of 40-80 percent oak, the average loss of basal area (mainly oaks) was about 16 percent (range 3-28 percent) following one year of defoliation and 26 percent (range 10-43 percent) after two consecutive years of defoliation. In both cases, droughty conditions likely contributed to the level of mortality.

Three management options have been evaluated for managing gypsy moth populations at Indian Head Naval Ordnance Station. The intervention options are offered based upon the following objectives: 1) protecting host tree foliage; 2) preventing tree mortality; and 3) reducing gypsy mtoh populations. Each is discussed below.

No Action Option

It is possible that gypsy moth populations could collapse on their own due to the presence of NPV (nucleopolyhedrosis virus) or the more recently recognized fungal pathogen, *Entomophaga maimaiga*. In areas with defoliating level gypsy moth populations (greater than 250 egg masses per acre) viral and fungal epizootics generally manifest themselves after significant tree defoliation has already occurred. Gypsy moth populations will usually peak in 2-3 years once they reach defoliating levels and then collapse as a result of NPV or fungal activity. Residual populations following such a collapse will likely remain at low densities for 3-6 years before rebuilding to defoliating levels. Although it is not possible to accurately assess such events with the information at hand, the large egg mass size and the recent population build-up at Indian Head Naval Ordnance Station suggest that this population as a whole is still building and a collapse is not likely to occur in 1994.

Should this option be selected, it is likely that population densities will increase and possibly expand to currently uninfested areas at this facility.

Chemical Insecticide Option

The second option is to use a chemical insecticide to control gypsy moth populations. Dimilin® (diflubenzuron) is the most widely used chemical insecticide in gypsy moth suppression projects in the northeast. Diflubenzuron (DFB) is an insect growth regulator that disrupts the normal molting processes of the larvae. The mode of action is to inhibit the formation of chitin, a necessary component of the outer cuticle which causes the affected larvae to die during the molt following treatment. The method of uptake is primarily by ingestion, however, recent research has indicated the possibility of absorption through the cuticle as well.

Dimilin is registered by EPA for use in residential areas. It is, however, extremely toxic to some aquatic invertebrates, and the label prohibits the application over open water or wetlands. The Maryland Department of Agriculture's current policy on the use of DFB is to provide a minimum of a 100-foot no-spray buffer around open waterways and wetland areas. DFB is available as a 25 percent wettable powder (Dimilin 25W), and an oil based liquid formulation (Dimilin 4L). Both formulations are applied in a single application. With proper application, foliage protection and a significant population reduction can be expected with DFB. The need for treatment of residual populations the following year would be unlikely.

Microbial Insecticide Option

The third option is to use a microbial insecticide to manage gypsy moth populations. The only biological insecticide currently registered and commercially available for gypsy moth control is the microbial insecticide *Bacillus thuringiensis* variety *kurstaki* (*B.t.*). This insecticide is available through several manufacturers and has been used extensively in suppression projects throughout the U.S. in both forested and residential areas. *B.t.* is a bacterium that acts specifically against lepidopterous larvae as a stomach poison and therefore must be ingested. The major mode of action is by mid-gut paralysis which occurs soon after feeding. This results in a cessation of feeding, and death by starvation. Although *B.t.* is considered to be more host specific than DFB, it has been shown to impact other non-target caterpillars that are exposed to the treatment and are actively feeding.

B.t. formulations are available as flowable concentrates, wettable powders, and emulsifiable suspensions. The normal application rates range from 20-36 billion international units (BIUs) per acre in a single application and 16-30 BIUs in double applications. *B.t.* can be applied either undiluted or mixed with water for a total volume of 1/2-1 gallon per acre. With proper application, foliage protection and some degree of population reduction can be expected with one application and with two applications both foliage protection and a greater degree of population reduction are likely. The degree of population reduction varies and may depend on, at least in part, the selected application rate, population densities and the weather (rain and temperature) and the feeding activity of the larvae following treatment.

Alternatives

With the previously described options in mind, the following four (4) alternatives are offered.

Alternative 1. -- No action.

Alternative 2. -- Single application of DFB.

Alternative 3. -- A single application of *B.t.* applied at the rate of 36 BIUs in a total mix of 1/2-1 gallon per acre.

Alternative 4. -- Two aerial applications of *B.t.* at the rate of 24-30 BIUs in a total mix of 1/2-1 gallon per acre. The second application should be applied 5-7 days following the first.

RECOMMENDATIONS

Our recommendation is to aerially treat the gypsy moth infested area consisting of approximately 175 acres in the Stump Neck section of Indian Neck Ordnance Station as described in Alternative 3. Treatment elsewhere at the Station will not be necessary.

This alternative was selected based on the following considerations:

1) population densities are not excessively high in that adequate population reduction to prevent the need for retreatment in 1994 is probable;

2) foliage protection and prevention of any subsequent tree mortality is achieveable;

3) a single application is more economical; and

4) *B.t.* formulations used for gypsy moth management have no known potential impact on aquatic ecosystems, particularly aquatic invertebrates at the recommended application rates.

5) the primary resource management objective for the proposed treatment area is timber production.

Table 1.--Gypsy moth egg mass survey results at Indian Head Naval Ordnance Station, September 8, 1993.

Plot Number	Number Egg Masses/Acre
1	0
2	0
3	0
4	40
5	0
6	0
7	0
8	0
9	0
10	0
11	40
12	0
13	0
14	0
15	0
16	0
17	0
18	880
19	2000
20	10,280
21	80
22	0
23	0
24	40
25	0
26	0
27	0

Station-Wide

Range = 0-10,280 EM/Acre
Average = 495 EM/Acre

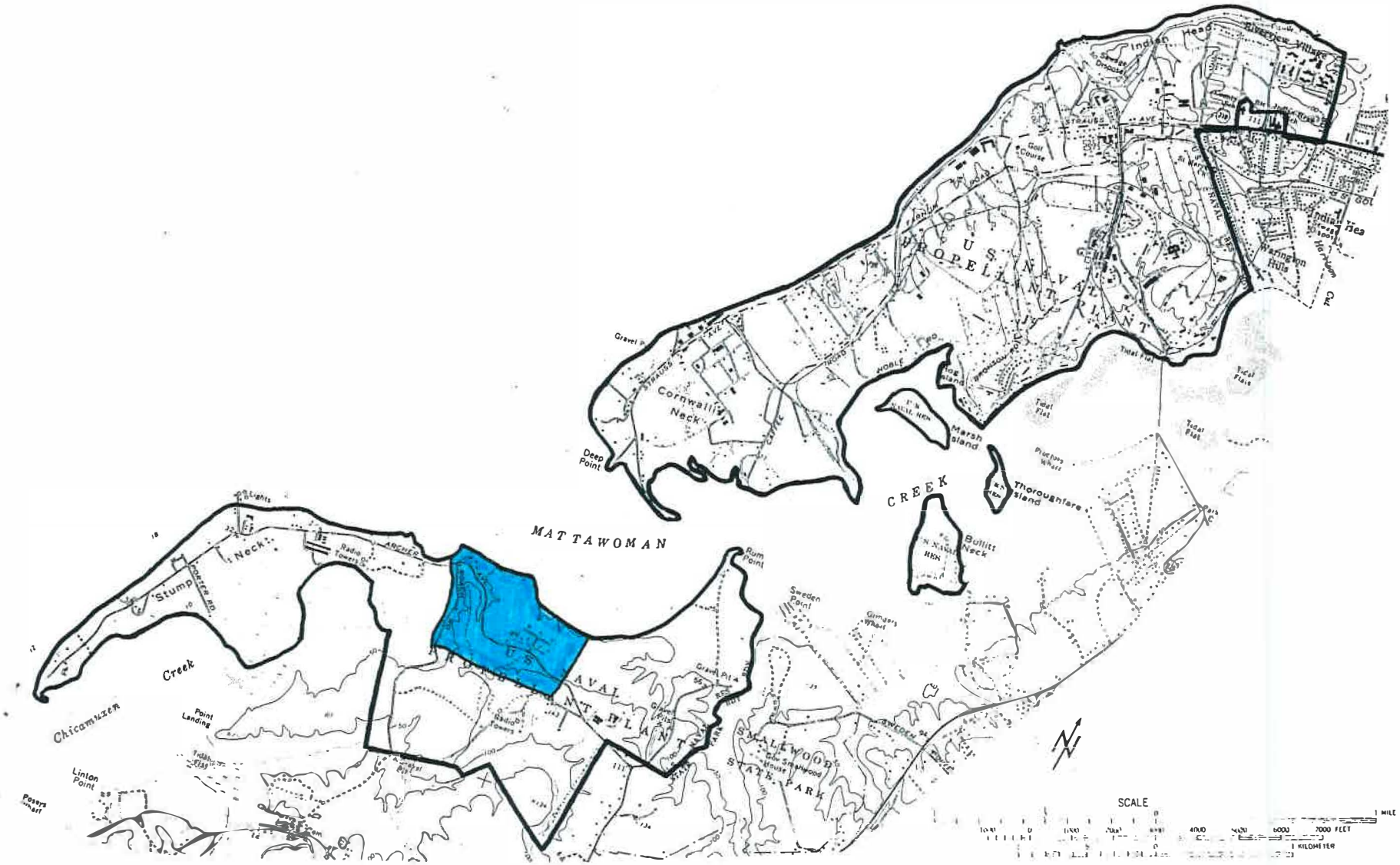
Proposed Treatment Area

Range = 40-10,280 EM/Acre
Average = 2656 EM/Acre

Fig 1. -- Gypsy moth egg mass survey plot locations
Indianhead Naval Ordinance Station, September 8, 1993.

● - Egg mass survey plot location

Figure 2. -- Indian Head Naval Ordinance Station
Area where noticeable defoliation is likely to occur/
Recommended treatment block.



- Area of likely defoliation / Recommended treatment block

United States Department of Agriculture | Forest Service | Northeastern Area State & Private Forestry | 180 Canfield Street Morgantown, WV 26505

Reply To: 3460

Date: November 16, 1993

Mr. Joseph Hautzenroder
Staff Forester
U.S. Navy
Naval Facilities Engineering Command
Washington Navy Yard
Washington, DC 20374

Dear Joe:

Enclosed for your information is the gypsy moth biological evaluation for Indian Head Naval Ordnance Station. Approximately 175 acres were found to have high gypsy moth population densities averaging 2656 egg masses per acre. We anticipate heavy defoliation (61-100 percent) to occur in this area if left untreated. Our recommendation is to aerially treat the infested area using B.t. applied in one application at the rate of 36 BIUs per acre.

The recommendation for treatment is based on: current population densities; abundance of host type species; expected defoliation intensities and potential for tree mortality; and your timber management objectives for this area.

If you have any questions regarding this report or would like assistance in carrying out our recommendations, please call me at (304) 285-1546.

Good luck and I look forward to working with you in the future!

Sincerely,

Rodney L. Whiteman

for BRADLEY P. ONKEN
Entomologist
Forest Health Protection

cc: AO
Jeff Bossart
Bob Tichenor, MDA
Steve Kincaid, Northern Division

Enclosure

BPO/mae